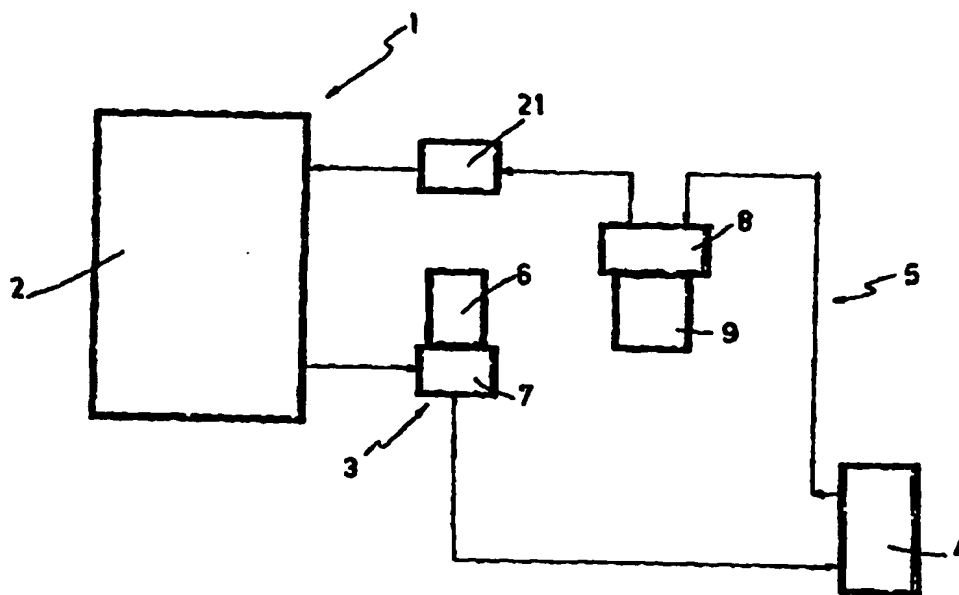




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(54) Title: APPARATUS FOR MICRODERMABRASION BY MEANS OF A JET OF A MIXTURE OF AIR/REDUCING SUBSTANCES AND RELATING HANDLE



(57) Abstract

Apparatus (1) for microdermabrasion by means of a jet, possibly pulsed, of a mixture of air/reducing substances consisting of a main body (2) wherein a vacuum pump and, possibly, a compressor are located, of a first mixing container (3), wherein the air is mixed with the reducing substances, of a second recovery container (5), wherein the used reducing substances are recovered, and of a handle (4) for applying said mixture; in the apparatus (1) the first (3) and the second container (5) are formed by coupling two cartridges (6, 9), apt to contain the reducing substances, with two locking means (7, 8), the functional parts being comprised in the locking means (7, 8).

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APPARATUS FOR MICRODERMABRASION BY MEANS OF A JET OF A
MIXTURE OF AIR/REDUCING SUBSTANCES AND RELATING HANDLE

10

TECHNICAL FIELD

Apparatus for microdermabrasion by means of a jet of a
mixture of air/reducing substances and relating handle

15

The present invention is used in aesthetics and/or
dermatology, concerning in particular an apparatus, and
the relating handle, for microdermabrasion, so that a
jet of reducing substances is applied on human tissue,
in particular a jet of corundum crystals (Al_2O_3).

20

The present invention can be used for all applications
of traditional microdermabrasion.

For example:

- post acneic scars;
- stretch marks;
- scars;
- 25 - hypertrophic scars;
- cheloids;
- cloasma;
- seborrhea;

- hyperpigmentation;
- fine wrinkles;
- cutaneous ageing.

5 Furthermore, the present apparatus can also be conveniently used in the trichologic field (e.g. peeling of the scalp).

BACKGROUND ART

The known apparatuses for microdermabrasion have three remarkable disadvantages:

- 10 (1) internal development of bacterial pockets, which are very difficult to remove;
- (2) obstruction of the circuits crossed by the mixture of air/reducing substances, wherein said obstruction causes the block of the apparatus;
- 15 (3) possible dispersion in the environment of reducing crystals, used together with particles of abraded tissue, which can be infective.

The European patent application EP-A-0 324 448 (L.I.C.A. of Rosso & C. Snc) and the European patent application
20 EP-A-0 318 042 (Molinari et al.) concern two apparatuses for the micro-abrasion of human epidermis. These devices do not solve either the aforesaid particular hygienic problems or those concerning the obstruction of the circuits. Furthermore, with regard to the handle
25 described in EP-A-0 318 042 (Molinari et al.), it must be specified that it is very expensive for its structure and material.

Also apparatuses using monobloc handles made of a glassy

material (in particular tempered Pirex) have been developed. In this case the handles do not show particular problems concerning obstruction or sterilization, but, because of the particular material
5 they are made of, they are rapidly worn out, thus becoming thinner, so that they could even hurt the patients.

All three apparatuses require the pouring out of the crystals, both in the loading and in the unloading
10 phase; therefore there could be a dispersion of crystals in the environment; if these crystals were used crystals mixed with particles of abraded tissue, there would be a dispersion of potentially infecting material.

DISCLOSURE OF INVENTION

15 The apparatus for microdermabrasion object of the present invention was designed according to innovative principles in order to overcome all difficulties which can arise by performing dermabrasion or abrasion of the scalp. The operator using said apparatus is provided
20 with recharging cartridges, each of them containing an amount of corundum which is sufficient for several operations. Once the cartridge is empty, the operator must replace it with a new one by moving the special locking means of the empty cartridge to the full one,
25 and he must perform the opposite procedure with the cartridge containing the used corundum. In this way the cartridge full of dirty crystals, namely mixed with particles of abraded tissue and potentially infecting,

can be sent to the waste disposal without pouring out the crystals, which always causes a certain dispersion of the crystals in the environment, with the following spreading of abraded tissue. With the apparatus object
5 of the present invention the whole loading and unloading of crystals is performed in few seconds, easily and without spreading the used crystals in the environment. Furthermore, the recharging cartridges can be sterilized, if necessary (previously sterilized
10 cartridge or corundum), being ready to use. The owners of the apparatus can buy the corundum cartridges at the same price of loose corundum.

Furthermore, if it were necessary for hygienic reasons, it would be possible to get rid of the recovery
15 cartridges, since they are very cheap (disposable use). The particular handle, which is a further object of the present invention, is composed by three parts which can be completely disassembled without using other tools, thus allowing a quick replacement of the functional
20 block inside it (which is necessary in order to accelerate crystals before the impact with the tissue to be abraded), wherein said replacement allows to vary the "mark" that the crystals jet produces on epidermis. Said mark can be more or less large and more or less deep
25 according to the length and the section of the small pipe contained in the functional block. The handle is conveniently provided with a plastic grip (e.g. plexiglas), whereas the head and the functional block

can be made of stainless steel. The inlet and outlet pipes of the crystals are conveniently made of extraflex with a quick joint in suitable pneumatic unions.

5 The main object of the present invention is therefore an apparatus for microdermabrasion by means of a jet of a mixture of air/reducing substances consisting of a main body wherein a vacuum pump and, possibly, a compressor is located, of a first mixing container, wherein the air is mixed with the reducing substances, of a second
10 recovery container, wherein the used reducing substances are recovered, and of a handle for applying said mixture. The apparatus according to the invention is characterized by the fact that the first and the second container are formed by coupling two cartridges, apt to
15 contain the reducing substances, with two locking means, the functional parts being comprised in said locking means.

A further object of the present invention is a handle which can be comprised in the apparatus object of the
20 present invention, but which can also be used with apparatuses for microdermabrasion different from the claimed one. Said handle consists of a head, a functional block and a grip, which can be easily assembled and disassembled in order to form the most
25 suitable tool for each operation.

Another object of the present invention is an innovative process for the superficial treatment of parts of human body by means of microdermabrasion, wherein the air apt

to form the abrading mixture of air/reducing substances is sent by pulses. In this process the pulsed air can be produced with a maximum pressure of 9 bars, with a frequency of 0.5-50 Hz and with a duty cycle varying from 5% to 50%.

It is furthermore claimed an apparatus for microdermabrasion by means of a jet of a mixture of air/reducing substances comprising a device which produces pulsed compressed air. Said device generating pulsed compressed air comprises on its turn a modulator, run by a pneumatic pedal, which drives a pneumatic group apt to produce a series of pulses of compressed air with a variable pressure. Said pulses of compressed air with a variable pressure are sent inside the crystals flowing circuit towards a handle for applying the mixture of air/reducing substances.

The problems solved by the present invention can be summarized as follows:

- (i) Absolute safety during the loading and unloading of the reducing materials, and possible disposable use of the cartridges;
- (ii) No obstruction, since it is possible to reach the crucial points of the circuit, which are the cannula and the functional block containing the small pipe;
- (iii) All functional parts are easily accessible and dismountable, thus making easier cleaning and sterilization;
- (iv) Choice of cannula and functional block, in order to

form the apparatus and the handle which are more suitable for each operation;

(v) No possible contamination of crystals cleaned from abraded human tissue, since the flux of the reducing crystals follows only one direction;

(vi) Possible microdermabrasion operations with a perfect sterility.

BRIEF DESCRIPTION OF DRAWINGS

The present invention will be better understood with reference to the accompanying drawings, which have a purely illustrative and non limiting scope, wherein figure 1 shows a block diagram of the apparatus object of the present invention;

figures 2a and 2b show, respectively, a side view and a view according to arrow II of the locking means of the recharging cartridge;

figures 3a and 3b show, respectively, a side view and a view according to arrow III of the locking means of the recovery cartridge;

figures 4a and 4b show, respectively, a side view and a longitudinal section of a first embodiment of the handle, which is a further object of the present invention;

figures 5a and 5b show, respectively, a side view and a longitudinal section of a second embodiment of the handle, which is a further object of the present invention;

figure 6 shows a general plan of the apparatus for

microdermabrasion provided with a generator of pulsed compressed air;

figure 7 shows in more detail the pneumatic group belonging to the generator of pulsed compressed air shown in figure 6.

BEST MODE FOR CARRYING OUT THE INVENTION

The block diagram of figure 1 represents the general structure of the apparatus 1 for microdermabrasion object of the present invention. The main body 2 comprises (not shown in the figure) an inlet pump necessary to the flowing of the mixture of air/reducing substances, an optional compressor necessary to give to the crystals a stronger kinetic energy, wherein said compressor is conveniently run by means of pneumatic controls (pump and pressure switch) and several regulation and display devices. Because of the produced vacuum said pump runs, together with the air suck in from outside, the corundum crystals present in the mixing container 3, which, once passed through handle 4, are recovered by the recovery container 5. For a part of the recovery container 5 the applicant conveniently used an empty recharging cartridge 6, which was intended to house the used crystals together with particles of abraded tissue coming from handle 4. Actually, the recharging cartridge 6, once empty, is unscrewed from its locking means 7 and screwed on the other locking means 8. The recovery cartridge 9, full of used crystals and of particles of abraded tissue, can then be expelled

during the following cycle.

The operations which must be performed by the operator, both in a conventional apparatus and in the apparatus object of the present invention, are the following:

- 5 a) turn the apparatus on and starting regulation of the required vacuum level;
- b) positioning of the handle 4 on the area to be treated;
- c) possible running of the compressor by means of the
10 pedal if a deep abrasion is required;
- d) pre-setting of frequency and duty-cycle if the operator wishes to work with pulsed air.

When the operator lays the outlet hole of handle 4 on the skin, the external air mixes with the reducing
15 crystals in the mixing container 3, thanks to the produced depression. This mixture is sent with a strong kinetic energy in the small pipe of handle 4, which accelerates said mixture directing it towards the outlet hole. In the collision the reducing crystals abrade the
20 skin of the patient and the mixture of air/reducing substances with the removed fragments is sucked in the recovering container 5, wherein both the crystals and the fragments of tissue lie on the bottom. Figures 2a and 2b show upside down possible locking means 7 for the
25 recharging cartridge 6. It consists of a main body 10, preferably made of aluminium, crossed by a mixing cannula 11 and a throttle valve for the external air 12. The mixing cannula 11 is conveniently made of brass and

is simply pressure-fixed, thus allowing an immediate replacement with one of the other cannulas provided with the apparatus. Locking means 7 can also be provided with a pneumatic union for linking it with the outlet duct of the compressor. The lock of locking means 7 on the recharging cartridge 6 is conveniently a quick lock, whereas the vacuum tightness is guaranteed by a suitable O-Ring. As already stated, locking means 7 is shown upside down; in fact, in the reality the main body 10 is the basis, and the hole 13 of cannula 11 allows the inlet of the reducing crystals which are dragged by the air coming in through end 14. It is clear that the easy removal of cannula 11 in order to adapt it to the needs of the user is a relevant element and a further advantage of the present invention. In fact, the choice of the diameter of hole 13 can be made according to the amount of crystals which must be present in the abrading mixture, with the same amount of sucked external air. Figures 3a and 3b show locking means 8 of the recovery cartridge 9 forming the recovery container 5. Said locking means 8 consists on its turn of a main body 15 crossed by a first filter 16 (conveniently a disposable one, e.g. a fuel filter) which can be fixed by means of a locknut 17. Locking means 8 is then completed by a duct 18 for the recovery of the used crystals. The aim of the first filter 16, which is cheap and easily replaceable, is to filter the air sucked in by the vacuum pump through the ducts 18, 19 and 20, thus

avoiding the passage to the pump of corundum crystals mixed with particles of abraded tissue. Also in this case it is advantageous the use of a quick lock between the locking means 8 and the recovery cartridge 9. In order to improve the safety of the whole apparatus, it is also possible to foresee at the outlet of locking means 8 a second safety filter 21 (figure 1), comprising a metal cartridge having a low porosity (5 microns), placed downstream from the first filter 16, which has a further protective aim for the vacuum pump, if there is an accidental boring of said first filter 16. Said second safety filter 21 is externally mounted on the main body 2 and can be inspected and sterilized.

Therefore, one of the main principles of the present invention is the use of the cartridges employed for stocking corundum crystals both as recharging cartridges and as recovery cartridges, also foreseeing locking means which can be rapidly coupled with said cartridges. Figures 4a, 4b and 5a, 5b show two embodiments of handle 4 for applying the mixture of air/reducing substances on epidermis.

In the first embodiment of figures 4a, 4b handle 4 is divided into three parts: head 22, functional means 23 and grip 24 (e.g. made of plexiglas). Head 22 is provided with an outlet hole 25, through which the reducing mixture is ejected on the skin of the patient, and a lock 26 which is connected to the evacuation pipe 27 of used crystals and particles of removed skin. The

mixture of air/reducing substances is sent through the duct 28 (figure 4a) to the handle 4. Also the functional block 23 represents a particularly advantageous solution of the present invention. In fact, it is possible a rapid replacement of functional block 23 in order to choose the most suitable section and length of the small pipe 29 according to the particular operation that must be performed. In this way it is possible to get on the epidermis of the patient "marks" more or less large and deep in order to have different abrading effects. For example, if you wish to abrade a small spot on the skin without affecting the surrounding tissue, you will choose a functional block 23 provided with a small pipe 29, longer and with a smaller diameter, which is able to send a narrow and powerful sheaf of crystals. If, on the other hand, you wish to treat uniformly a large spot, you will choose a small pipe 29, shorter and with a larger diameter. The head 22 (which can also be made of stainless steel or can be a disposable one made of plastic) can be chosen on its turn with an outlet hole 25 suitable to the used functional block 23. Furthermore, in this first embodiment, the shape of the head 22, having an upper return duct 30 which is perpendicular to the central axis of the head 22, allows the mixture of air/reducing crystals to maintain more kinetic energy at the moment of the impact with the tissue to be abraded. All three elements 22, 23 and 24 forming the handle 4 can be easily assembled and

disassembled in order to form the most suitable handle 4 for each operation. The coupling between the head 22 and the functional block 23 can be pressure-fixed or can have a threading, whereas the vacuum sealing effect is
5 guaranteed by a suitable O-Ring.

According to the aforesaid, the handle 4 is particularly suitable to abrade small regions of the face without affecting the surrounding areas (contour of mouth and eyes), or to remove very small imperfections or spots on
10 the skin, which is a very difficult operation if performed with conventional handles.

Figures 5a, 5b show a second embodiment of the handle 4 which is a further object of the present invention. It consists of a grip 31 (e.g. made of plexiglas or PVC),
15 through which both connecting pipes of handle 4 pass (ejection and recovery), of a functional block 32, which is pressure-fixed inside the grip 31 and comprises both the small pipe 33 and the crystals return duct 34, and of a head 35 presenting an outlet hole 36. The head 35
20 can be pressure-fixed to the functional block 32 or can be fixed by means of a threading. Said version of the handle 4 offers a very good performance for each kind of use, but is particularly suitable when large areas must be treated.

25 It is particularly advantageous the pulsed working of the apparatus for microdermabrasion object of the present invention. This term indicates a device generating pulsed compressed air which sends the air to

the handle in order to perform the aforesaid treatments. This new working was created in order to satisfy the necessity of making deep abrasions on small skin areas, reducing to the minimum the warming of the surrounding tissue and the induced pain. Practical tests on patients confirmed the efficiency of said method; furthermore, is was noticed that, by varying the frequency and the duration of pulses, it is possible to use this method for most applications of microdermabrasion.

Figure 6 shows the general lay-out of the device generating pulsed and compressed air 37. It comprises a modulator 38, with adjustable frequency and duration, conveniently made by means of a simple electronic circuit, which drives the pneumatic group 39 apt to provide a jet of compressed air with variable pressure (0.5-9 bars). As shown in figure 6, said pneumatic group 39 is fed by tank 40, which is filled with air by the compressor 41. Said pulses of compressed air are then suitably sent inside the crystals flowing circuit previously described, thus producing a jet of the mixture of air/crystals coming out from handle 4. This sequence of pneumatic pulses confer to the crystals a remarkable energy, provided within little lapses of time and can produce, as a final effect, deep but scarcely painful abrasions. The pulse timings are conveniently settled in the following way:

frequency: 0.5-50 Hz

duty cycle: 5-50%

The pneumatic group 39 is essentially made of one or more pressure reducers ruling the maximum usable pressure, from a solenoid valve driven by the aforesaid pulse modulator 38 which connects and disconnects the compressed air flux according to pre-set frequency and duration, and of a pressure-switch, driven by the pneumatic pedal 42, acting the modulator 38.

The aforesaid pedal 42 allows a continuous control of air, so that the outlet pressure varies from 0 bars to the maximum pre-set value, according to the strength exerted by the foot on the pedal. Therefore, fully pushing the pneumatic pedal 42, an outlet sequence of pulses is obtained, which have the maximum pre-set pressure, whereas, partially pushing the pedal, pulses provided with an intermediate pressure are obtained. This allows the operator to direct the operation according to his personal feeling, since he can use a continuously modulated regulation by means of the foot pressure on the pneumatic pedal 42.

Figure 7 shows in more detail the pneumatic group 39 shown in figure 6. The pressure of compressed air going out of the tank 40 is limited by means of a pressure relief device 43, to a maximum value (e.g. 9 bars) which can not be exceeded by the user. Downstream from said pressure relief device 43 there is a pressure regulator 44 driven by the operator, which allows the setting of the maximum pressure (displayed by the pressure gage 45) required for the treatment. A first solenoid valve 46

controls the taking of the compressed air coming out from the pressure relief device 43, and controls the discharge of the residual pressure through the duct 47, in order to disconnect the pneumatic pedal 42 without producing unsuitable compressed air jets. The pneumatic pedal 42, on its turn, sends the compressed air to a second solenoid valve 48 with a quick discharge, which is also provided with an evacuation duct 49 of the residual air and at the same time it acts the pressure-switch 50, which runs the modulator 38. Said pulse modulator 38 modulates the opening and locking phase of the second solenoid valve 48 with a quick discharge according to the frequency and duration pre-set by the operator. Thus, from the second solenoid valve 48 a series of pulsed compressed air is found, which is directed to the handle 4 through the recharging cartridge 7 containing the clean corundum crystals. The pneumatic pedal 42 is also provided with a discharge duct 51 for the residual air. Said ducts 47, 49, 51 allow to get rid of the residual compressed air present in the various areas of the pneumatic circuit, thus allowing the formation of several pressure pulses.

Without departing from the scope of the present invention the skilled in the art can make to the apparatus and the handle objects of the present inventions all modifications and improvements suggested by the experience and by the natural evolution of technique.

CLAIMS

1. Apparatus for microdermabrasion by means of a jet of
5 a mixture of air/reducing substances comprising a main
body, wherein a vacuum pump and, possibly, a compressor
is located, a first mixing container, wherein the air is
mixed with the reducing substances, a second recovering
10 container, wherein the used reducing substances are
recovered, and a handle for applying said mixture,
wherein the first and the second container are formed by
coupling two cartridges, apt to contain the reducing
substances, with two locking means, the functional parts
being comprised in said locking means.
- 15 2. Apparatus for microdermabrasion according to claim
1, wherein the locking means of the recovery cartridge
can be coupled with said cartridge by means of a quick
lock, and comprises a main body crossed by a mixing
cannula, a throttle valve for the regulation of the
20 external air and, possibly, a union for linking it with
the outlet duct of the compressor.
3. Apparatus for microdermabrasion according to claim
2, wherein said mixing cannula is simply pressure-fixed
on said main body, thus allowing an immediate
25 replacement with one of the other mixing cannulas
provided with the apparatus.
4. Apparatus for microdermabrasion according to claim
1, wherein the locking means of the recovery container

can be coupled with said recovery cartridge by means of a quick lock; said locking means consisting of a main body crossed by a disposable filter fixed with suitable means to said main body, and of a duct for the recovery of the used crystals.

5 5. Handle for apparatuses for microdermabrasion comprising a head, a functional block and a grip, which can be easily assembled and disassembled in order to form, after the replacement of the functional block, the most suitable handle for each operation.

10 6. Handle according to claim 5, wherein the crystals return duct is external to the grip.

7. Handle according to claim 5, wherein the crystals return duct is internal to the grip.

15 8. Use of the handle according to claims 5-7 in an apparatus according to claims 1-4.

9. Process for the surface treatment of parts of the human body by means of microdermabrasion wherein the air apt to form the abrading mixture of air/reducing substances is sent by pulses.

20 10. Process according to claim 9, wherein said pulsed air is sent with a maximum pressure of 9 bars, with a frequency of 0.5-50 Hz and with a duty cycle varying from 5% to 50%.

25 11. Apparatus for microdermabrasion by means of a jet of a mixture of air/reducing substances comprising a device which produces pulsed compressed air.

12. Apparatus according to claim 11, wherein said

generator of pulsed air comprises a modulator run by a pneumatic pedal which drives a pneumatic group, apt to produce a sequence of pulses of compressed air with a variable pressure, said pulses of compressed air with an adjustable pressure being driven inside the crystals flowing circuit towards a handle for applying said mixture of air/reducing substances.

13. Apparatus according to claim 12, wherein said pneumatic group comprises a pressure relief device, a first solenoid valve and a second solenoid valve, respectively placed upstream and downstream from said pneumatic pedal, and a pressure-switch run by said pneumatic pedal; said second solenoid valve being run by said modulator and by said pneumatic pedal.

14. Apparatus according to claim 12, wherein said generator of pulsed air comprises a plurality of discharge ducts of the residual air.

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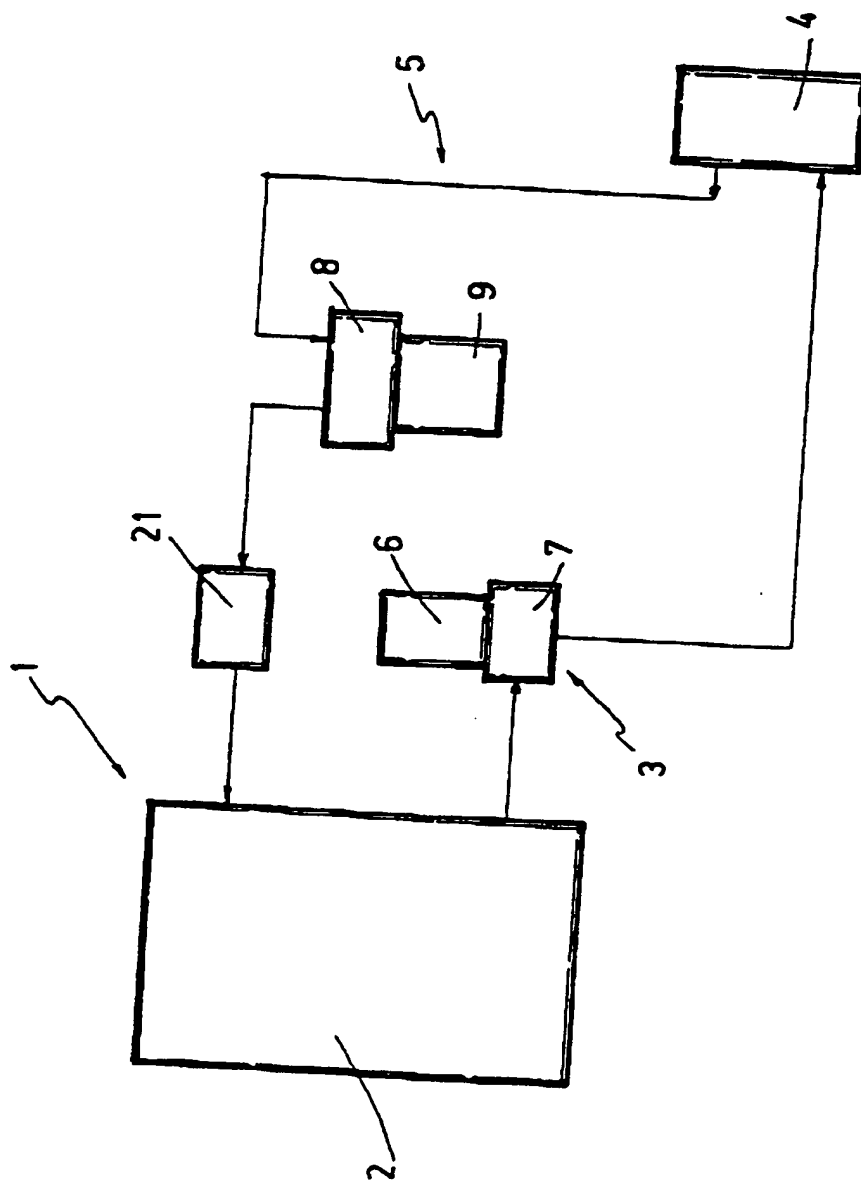


Fig.1

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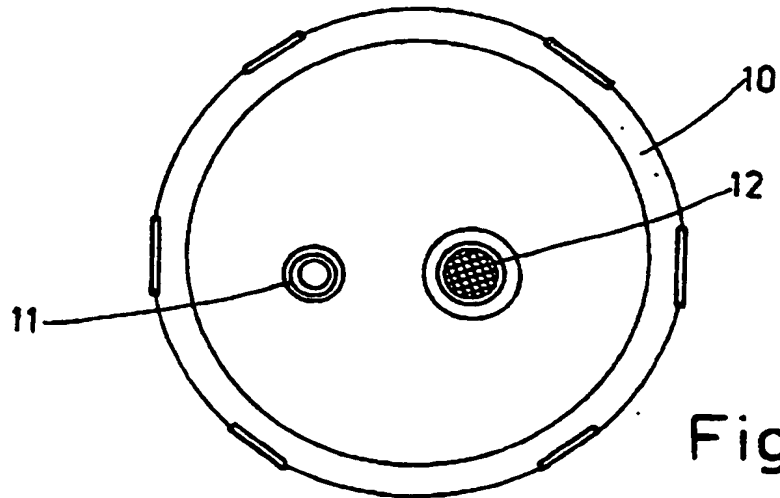


Fig.2b

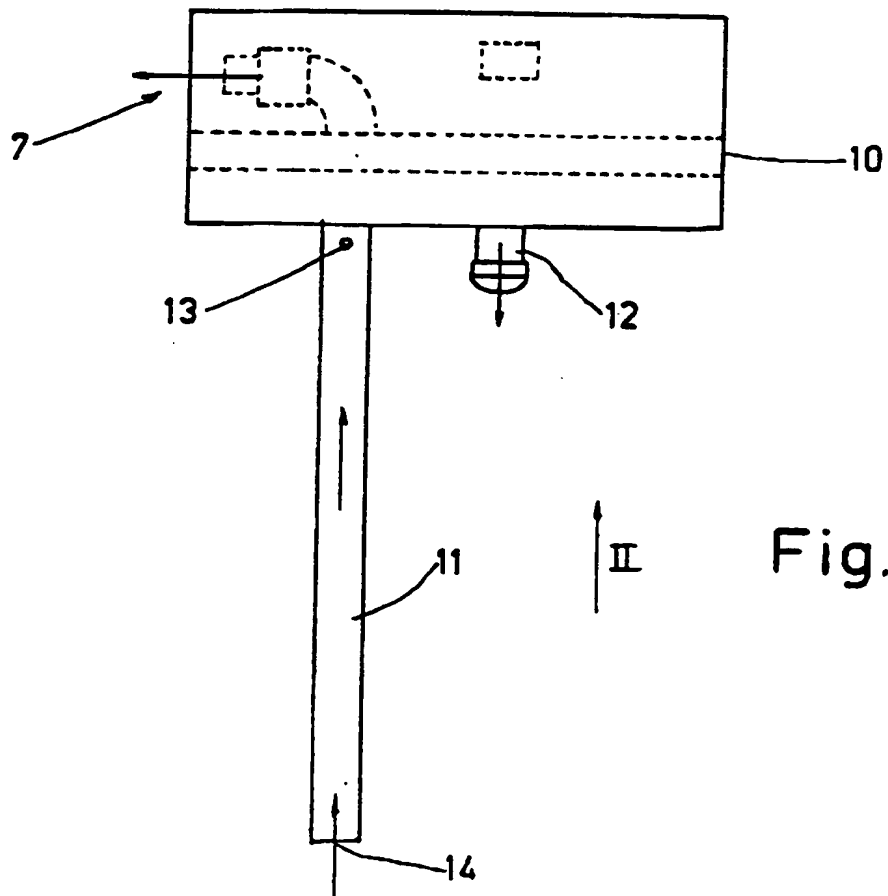


Fig.2a

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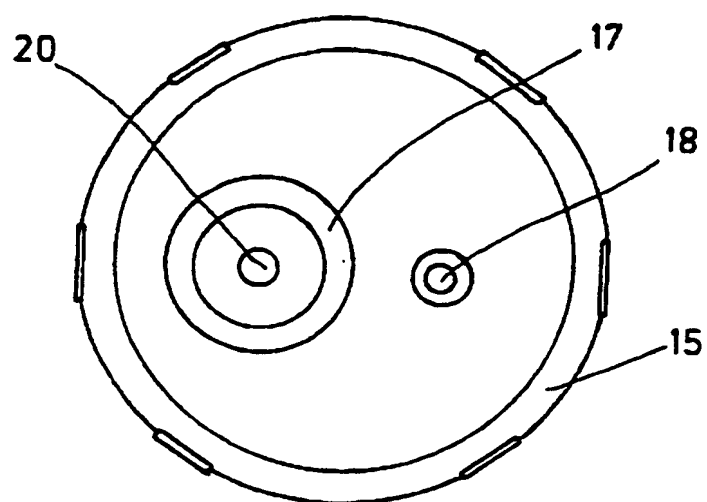


Fig.3b

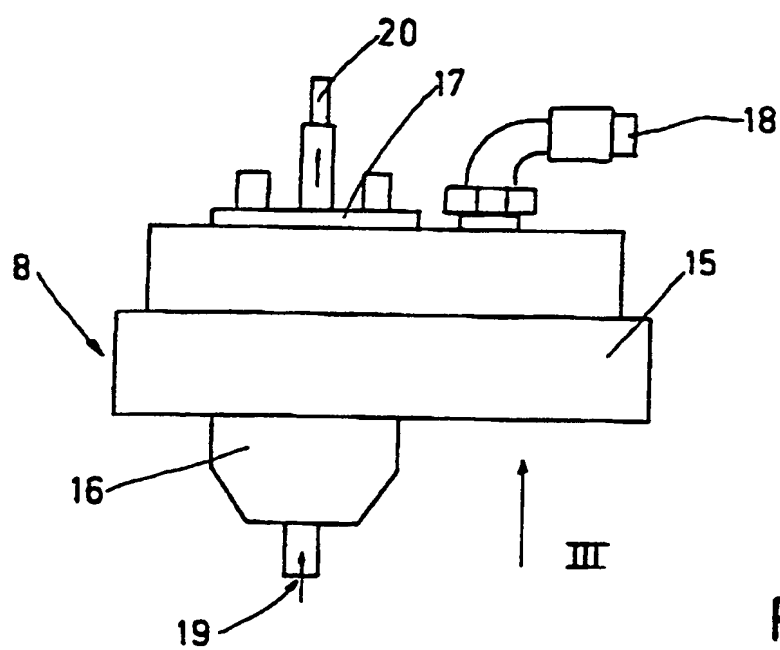
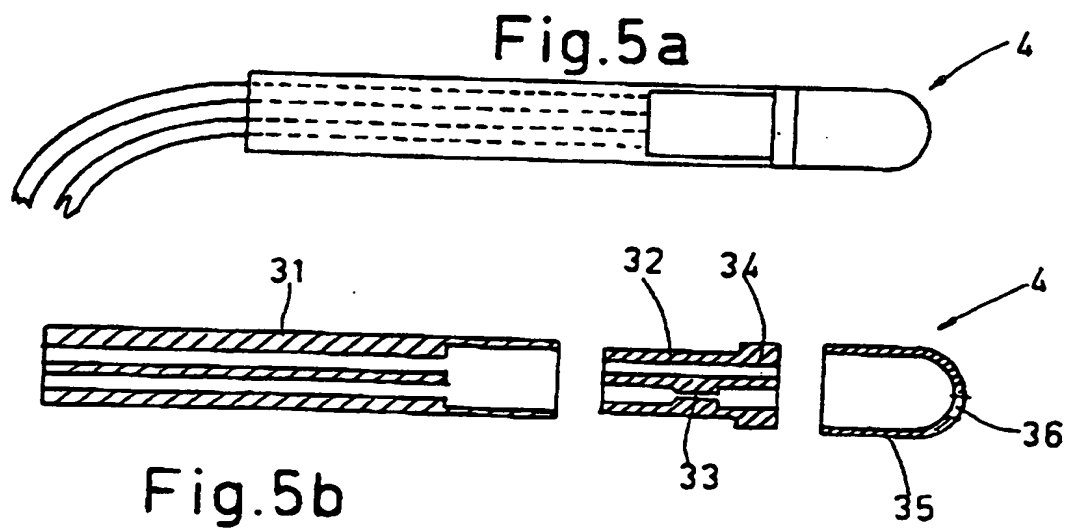
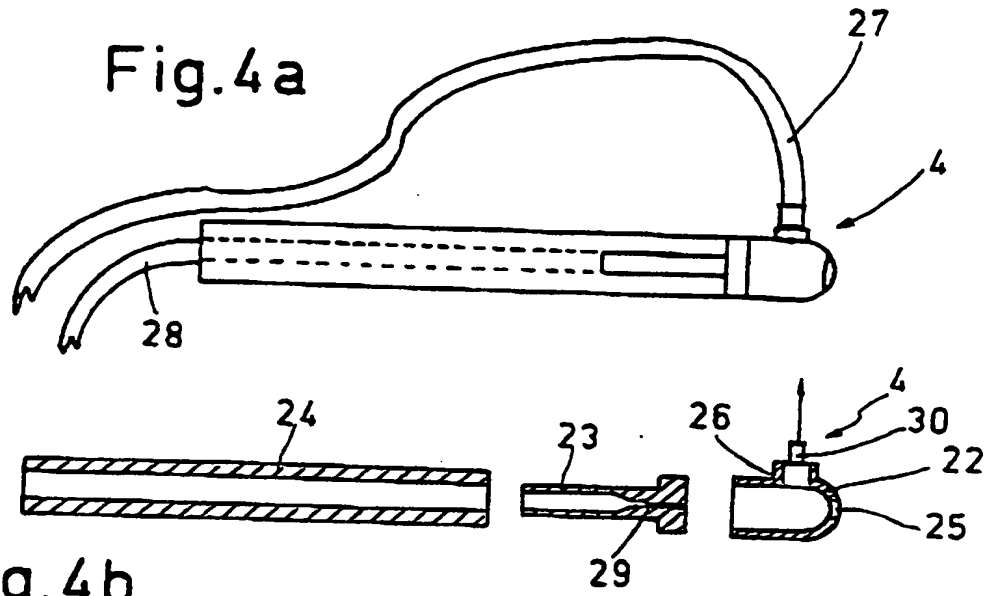


Fig.3a

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